Remote Community Hydro Feasibility Study-Oba

Ontario
Ministry of Energy
Honourable Philip Andrewes Minister
Energy Ontario

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REMOTE COMMUNITY HYDRO FEASIBILITY STUDY - OBA, ONTARIO

PRELIMINARY ENGINEERING

FINAL REPORT

APRIL 1983

Prepared For

THE ONTARIO MINISTRY OF ENERGY

By

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ABSTRACT

A potential small hydro power generating site has been identified and evaluated near the isolated, railway-based community of Oba, in northern Ontario.

This site has been selected from three alternatives that were identified in a 1979 study by Ontario Hydro.

As presently envisaged by this conceptual design and preliminary engineering study, the total cost of the plant, plus necessary transmission line, is $889,450.00 in 1982 dollars. The $850,000.00 approximate value derived during a Stage 1 Feasibility Analysis, July 1982, is in reasonably close agreement.

If the work was to proceed under present-day (1983) general economic conditions, the actual cost (with requisite ongoing engineering evaluation, design and project management services is likely to be somewhere between the two estimates and probably closer to the original figure.

FOREWORD

The Ontario Ministry of Energy would like to point out that the following study has taken into consideration all possible contingencies in the preparation of the final cost estimate. Therefore, the real cost to install a system may be significantly lower than that quoted.

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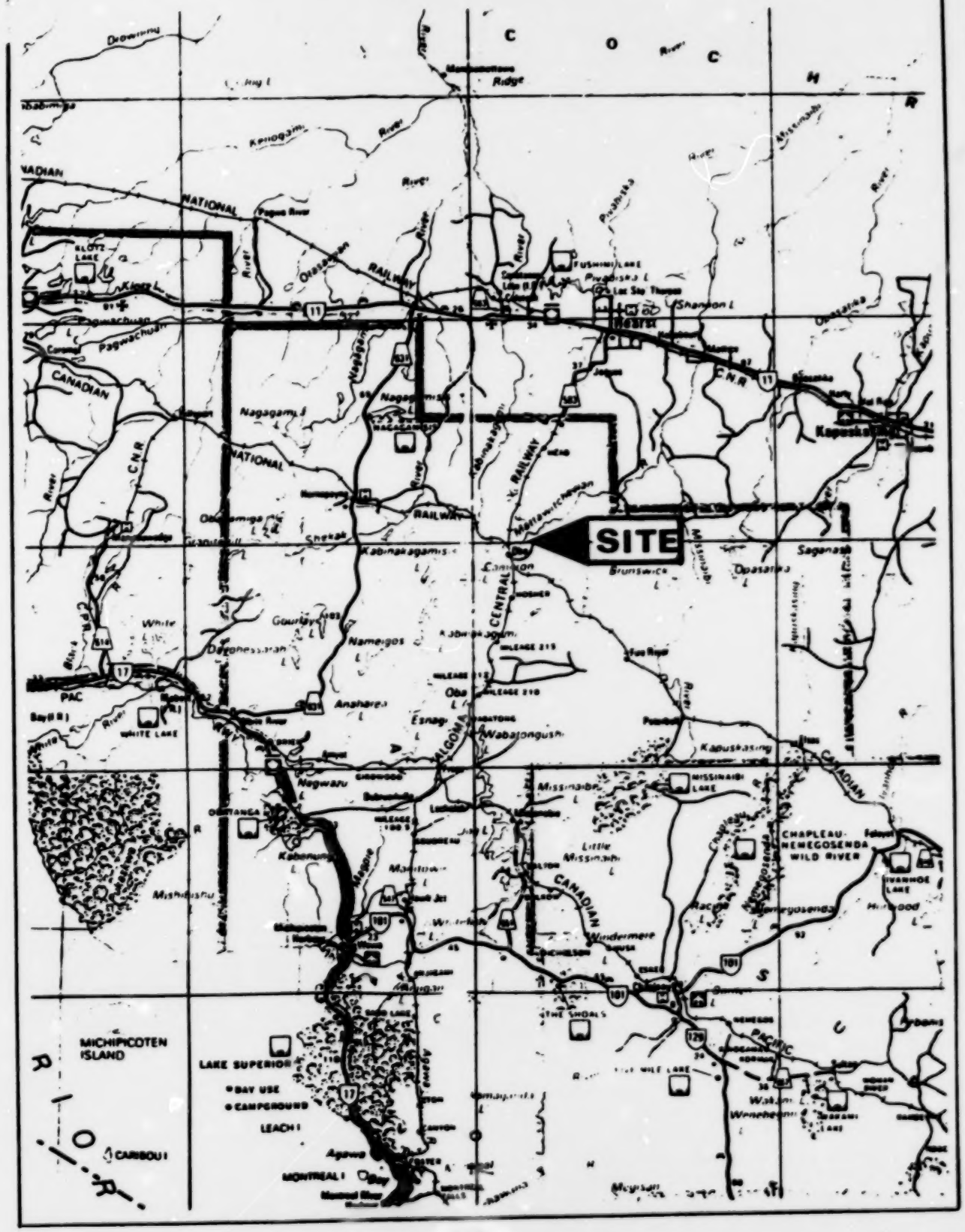
Project Reference 03/81.113
Final Report April 1983

LOCATION MAP



EXECUTIVE SUMMARY

The community of Oba in Northern Ontario is an isolated railway-based settlement located at the junction of the main line CNR and the Algoma Central Railway, about 300 km north of Sault Ste. Marie and 50 km south of Hearst.

In its 1979 assessment of potential small hydro-electric power sites for the supply of electricity to remote communities, Ontario Hydro identified three in close proximity to Oba. Two of these sites were located on the Oba River and one on the Mattawitchewan River. The latter is a bifurcated alternative channel of the Oba River that ultimately discharges into the Missinaibi - Moose River System rather than the Albany River System into which the waters of the Oba River ultimately discharge.

Each of the three sites was studied in some detail during the Stage I Feasibility Analysis of the subject review. As a result of this study, the two sites on the Oba River were rejected in favour of the site which is located on the Mattawitchewan River, at the geographical location known as "The Chutes". This site was designated as Site A by Ontario Hydro and this identification has been retained throughout the subject study.

It is estimated that Site A, about 6 km straight line distance from the community of Oba, can produce in the order of 60 to 70 kw of energy throughout most of the year provided that sufficient low level flow can be diverted from the Oba River at the bifurcation at Albany Forks. This capability remains to be confirmed through further detailed hydraulic, environmental and ripparian rights studies of both the Oba and Mattawitchewan River sytems.

The results of the preliminary engineering studies and conceptual design development of the proposed works are presented in this report, which augments the findings given in the Stage I Report of July 1982. Total cost of the project as now envisaged is estimated at $889,450.00, versus the approximate $850,000.00 cost estimate made in the feasibility review. The difference between these estimated costs is not substantial and is believed on the basis of present information to be attributable to the overall uncertainty remaining over the potential environmental and flow control constraints which drive from the unique headwater bifurction, particularly where these impact on construction requirements. Actual costs would probably lie somewhere between the two estimates, particularly if construction were to proceed during the present tight economic period.

It is a firm recommendation that the necessary detailed hydraulic, hydrology and environmental studies be carried out, so as to resolve the critical influence of the Oba - Mattawitchewan Rivers bifurcation provided that the results of such study confirm that appropriate low flow conditions are obtainable down the Mattawitchewan River, then the project would appear to be viable.

1.0 INTRODUCTION

1.1 Location

The proposed location for the demonstration small hydro project at Oba is at "The Chutes" on the Mattawitchewan River, approximately 6 km north of the settlement. This site was designated as "Site A" in Ontario Hydro's "Inventory of Potential Hydro-Electric Power Sites for the supply of Power to Isolated Northern Railway Communities". A plan showing the location is given in Drawing 1.

1.2 Site, Topography

The Chutes feature comprises a 200 m long section of river in the form of a relatively narrow, shallow gorge wherein the river bed has eroded through the overburden cover to expose a series of irregular Precambrian rock ledges. The sides of the gorge appear to comprise silty sediments or tills. The water presently flows over the rock, through a series of notches or irregular sills and chutes.

The community access road between Oba and Mead crosses the gorge at about mid-point. Some reconstruction would be required to fit the present road into the flow control structure (ie. intake, sluiceway and dam) and to replace the present culvert.

Water level in the Mattawitchewan River downstream of The Chutes is approximately El. 313.5 m. Upstream level at normal flow appears to be about El. 319 to 320, yielding a total drop in head of about 6.5 m.

1.3 Flow

Flow in the Mattawitchewan River at the selected location is derived from two sources:

i) The relatively small direct tributory drainage basin that exists between the site and the Oba River, and

ii) from the Oba River System as a result of its unique bifurcation at Albany Forks.

Preliminary hydrology studies to assess the feasibility of a small power development at this site, reported in our earlier Feasibility Study Report of July 1982, have been based on the assumption that some portion of the flow in the Oba would normally be available for power production and that additional water could be directed to the site by:

i) the removal of obstructions on the Mattawitchewan below Albany Forks, and

ii) a possible rock fill through-flow weir or submerged structure at Albany Forks.

Before any development work is undertaken, it will be essential to confirm these assumptions through a detailed hydraulic study of the two river systems. As part of this recommended investigation, stream gauging stations must be established at The Chutes and on the Oba River below Albany Forks, to obtain measurements of the normal flow for calibration of the river system model over a period of at least one year.

Under existing conditions, the flow through The Chutes is controlled by the sill level of the bedrock ridge at the head of the rapids relative to the water surface elevation and flow in the Oba River. Estimated flows derived for a previous report, "Remote Community Hydro Feasibility Study - Oba" (July 1982) are presented in Table 1. Excess flood discharge tends to be down the Oba River, due to back watering behind the topmost rock sill of The Chutes.

1.4 Head

The total available head at the site is approximately 6.5 m which may be increased slightly (.25 m) with channel improvements and a dam at the head of the rapids. An available flow of 1.5 m^3/sec would therefore generate in the order of 60 to 70 kw of electricity. Further head capacity might be possible by channel clean-up downstream of the stilling pool.

The unique overall physical constraints of the site and its relationship to the Oba River at Albany Forks will not permit a significant fluctuation in the available head for power generation; consequently, a fixed blade turbine can be used to exploit the power potential at this location.

It is unlikely that flood stage level in the forebay at the head of The Chutes will rise above El. 320 to 320.5, though this needs review.

1.5 Low Flow Bypass

Under low flow conditions it is reported by local residents and representatives of the Ministry of Natural Resources that there is normally little or no flow through The Chutes. To avoid any problems as a result of downstream ripparian rights, a by-pass

around the unit is proposed which can be operated during periods when the flow in the river is inadequate for power generation or when the unit is shut down.

2.0 ENGINEERING REQUIREMENTS, COST ESTIMATES

2.1 Channel Improvements

The depth of the Mattawitchewan River between Albany Forks and the proposed site at The Chutes varies from about 3.5 m at the deepest locations near Albany Forks to approximately 0.3 m at The Chutes, with a number of local shallow riffles between. To ensure an adequate flow to the proposed power installation without excessive head loss, the obstructions or channel restrictions that are causing these riffles must be removed. During the reconnaissance of the river it appeared that each of these was quite localized and in some instances appeared to be solely the result of a tree having fallen across the stream, or an old beaver dam. In no instance was there any indication of the presence of a bedrock ridge. A plan of the reach is given in Drawing 2.

Since the quantity of material involved at each location is not significant, it should be possible to remove each obstruction using a small dragline. Approximately one day's work might be involved at each point at a maximum. The major cost of this work will be associated with gaining access, although lumbering operations in the immediate vicinity may assist in this regard. This aspect of the work will have to be reviewed when the project is to proceed, in order to locate all the forest access roads that may exist and to determine their proximity to the various work sites, to identify additional clearing requirements.

Visual examination of the subject reach of the river during this study revealed five locations at which some channel excavation will be required. To determine specific locations, to quantify excavation volumes and to locate spoil areas will require a thorough hydrographic survey of the entire reach. This work can be undertaken using a strip chart depth recorder to pinpoint problem areas where detailed soundings can be obtained. On the Mattawitchewan, the data to be obtained is necessary for the final design of the channel. Similar information is required on the Oba downstream of Albany Forks to locate the controlling section and to evaluate the effect on that river system of any increased flow diversion down the Mattawitchewan*.

In addition to, and in conjunction with the foregoing river hydraulics studies, an investigation to resolve the overall basin hydrology and assess the impact of the proposed works on the natural and social environment on the down flow area of both Oba and Mattawitchewan basins will be required. The extent of this work cannot be determined without some preliminary hydraulic information; consequently it is suggested that an allowance of $25,000 be included for the task. If an environmental assessment of the complete installation is judged to be required based on the recommendations of the draft environmental assessment for remote power projects, then a further $15,000 should be added to the $25,000 estimate. At present the production or need for such an enlarged environmental impact statement is not envisaged, therefore the $25,000 estimated cost has been carried in this evaluation.

The estimated cost of the proposed work in this and the following sections was determined on the basis of discussions during the 1981/82 winter with several Northern Ontario contractors, plus purchasers of capital works, and on past experience in the design and construction of hydraulic structures.

On this basis, the estimated cost of the channel improvements, including the establishment of a small construction camp, and of the requisite engineering and environmental studies is $160,000 (Table 2).

2.2 Dam

The proposed site at The Chutes on the Mattawitchewan River is ideally suited for the installation of a small demonstration hydro-electric generating station. At this location the river drops approximately 6.5 metres over a distance of about 200 metres in a bedrock gorge. The main part of the walls of the gorge are in overburden.

To regulate the flow of water through the power plant and in the riverbed in the gorge, a small dam is required. The structure being proposed is higher than would be necessary for hydro power purposes but is suggested in order to accommodate the only vehicular access road to Oba. This accommodation of the road across the top of the dam will eliminate a culvert or bridge for the road at its present alignment across the downstream part of The Chutes.

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* This work must be completed before a decision can be made as to whether or not to go ahead with the project.

Both upstream and downstream faces of the envisaged dam will be sloped at 2:1 and each will be protected against erosion with a layer of stone rip-rap. Seepage through the dam will be controlled by a permeable filter and drainage system along the downstream face. This will be extended into the banks at either end of the dam as protection against piping through the natural overburden.

Preliminary details of the proposed structure are given in Drawings 3 and 4. The suggested design details are based on an initial visual assessment of the soil conditions prevailing in the area. To substantiate these will require a geotechnical investigation of the site, comprised of four boreholes through the sandy silt overburden and core drilled into the underlying bedrock. As the holes are advanced, soil samples will be obtained from each for laboratory testing. In situ permeability tests will be required for correlation with the laboratory derived data. Cost for this study is estimated at $4,800.

A comprehensive investigation using aerial photographs and field inspection will be undertaken to identify borrow areas for the requisite construction materials. This work, if done along with the detailed geotechnical investigation of the dam site and powerhouse, is estimated to cost $2,700.

The estimated overall cost of the dam and realigned roadway is $109,150 of which the largest item is for earth fill haulage and placement, see Table 3. It is possible that the earth fill item is high, since actual cost will be very dependent upon the general construction work available to local contractors at the time the bids are called.

2.3 Intake Structure

The rock ridge at the head of The Chutes is the principal control for flow from the Oba system into the Mattawitchewan River. It is at this location that the dam and headworks needed to divert the flow through the power unit are proposed.

To ensure sufficient submergence during the winter and at time of summer low flow, the intake structure will have to be constructed in an excavation in the bedrock. A simple concrete structure design is suggested, approximately 4.0 m square in plan and 5.0 m deep, with the structure set away from the body of the dam for maximum simplicity in design and

minimization of overall costs. The deck will be at the same elevation as the crest of the dam to permit easy access to the operating equipment. A protective fence will be required; also an operating metal grid deck with space to store stop logs and log and trash rack hoist equipment. The base of the structure will be not less than 2.0 m below the bedrock surface, which will be sufficient to ensure that it will not float when emptied internally at maximum head pond submergence.

Flow entrance to the intake will be protected with a steel trash rack to prevent floating debris from passing through the system to the turbine. The trash rack will be provided with a hoisting mechanism so that it may be raised to the surface for maintenance, while flow into the intake is cut off by stop logs.

Two manually operated sluice gates will be provided to direct the flow through the power unit or down the watercourse via the minimum low flow bypass conduit. Such bypass will be included to allow such constant minimum discharge as may be needed to satisfy downstream ripparian users and owners. Flood discharge will continue down the Oba River.

Stop logs and checks will also be provided to permit the intake and penstock system to be drained, should this be necessary at any time, such as for trash rack clean-up. A bypass conduit extension to the face of the intake will be needed if continuous flow discharge is demanded.

As noted, preliminary details of the proposed structure are illustrated in Drawing 5. Minimum submergence of the crown of the Penstock entrace by 1.5 m will be provided (or 2.0 m if the eliptical cone shaped transition is set with the long axis vertical.

The alternative of locating the intake structure within the body of the dam has been considered, but appears to add to development costs by need of more complex intake geometry for trash rack, trash rack rake (if rack is not removable) stop logs, low flow bypass and sluice gates. Embankment percolation cut-off walls would also be required to prevent preferred path seepage through the shortened section of fill.

It is estimated that the cost of the components as suggested will be $71,000, see Table 4. This estimate does not include the low flow bypass conduit, which has been priced along with the penstock (Section 2.4).

2.4 Penstock and Bypass

The penstock leading from the intake structure to the power generating unit and the bypass pipe will be installed beneath the base of the dam in a common trench in the bedrock. This trench will be backfilled over the entire width of the dam with mass concrete to guard against seepage along the pipes. Such mass concrete infill of the trench in bedrock will also facilitate the placing and compaction of the overlying earth fill embankment.

It is proposed that the penstock will comprise 1500 mm diameter steel pipe, installed in a straight line from the intake to the unit. Treated wood stave conduit could be evaluated as a possible alternative but it is felt that the existence of a major steel producer and several associated steel fabrication firms at Sault Ste. Marie will ensure a competitive cost for the steel pipe. However, a wood stave conduit would eliminate expansion problems.

An eccentric cone-shaped transition tapering from 2000 mm x 1500 mm to 1500 mm diameter will be constructed at the inlet to minimize entrance losses, while gradually accelerating the water up to 0.85 m/sec in the pipe. The pipe will be anchored by the concrete encasement in the base of the dam and any movement will be toward an expansion joint located at midpoint along the line. At the downstream end it will be restrained against movement by a concrete thrust block constructed integrally with the foundation for the unit. Throughout most of its length the pipe will be above existing ground level. Intermediate concrete supports founded on bedrock will be provided at about 7.5 m intervals. For illustration see Drawings 4, 5 and 6.

To finalize the alignment of the penstock, a detailed topographic survey of the valley and an assessment of the bedrock conditions along the proposed route will be required.

A bypass pipeline 450 mm in diameter is proposed to supply water to the upper reaches of the Mattawitchewan River during periods of low flow and when the power unit is shut down. For illustration see Drawings 4 and 5. Where it emerges from beneath the dam it will be directed into the existing stream bed to discharge on the exposed bedrock.

If a demand exists for uninterruptable minimum flow down the Mattawitchewan River, the inlet for the bypass must be moved forward to the upstream face of the intake structure.

The estimated cost of the steel penstock and simplest bypass pipeline is $227,000 determined as shown in Table 5.

2.5 Turbine/Generator

To identify a turbine generator package for the project, eight potential suppliers were contacted and invited to submit proposals with details of their equipment. Four of these responded and three provided information on their equipment. Their submissions are included in Appendix A.

The unit tentatively selected for this demonstration project is produced by Galt Energy Systems of Cambridge, Ontario. It is comprised of a propellor turbine manufactured by the company and a synchronous speed generator produced by Kato Manufacturing. Flow through the selected turbine is regulated by a butterfly shut-off valve installed at the inlet to the pressure casing. Rotational speed of the unit will be controlled by a Woodward Type UG Hydraulic Governor. This will allow the hydraulic unit to be operated independently from the present diesel generators.

The entire unit will be enclosed in a weathertight steel cabinet, with the complete assembly to be bolted to a concrete foundation pad cast in direct contact with bedrock at the foot of the rapids. The concrete foundation pad will be bolted to the rock to prevent uplift or lateral dislodgement by ice formation. A steel pivoting upright will be provided so that the entire unit or the weather-tight housing can be lifted off the base for maintenance purposes.

Preliminary details of the installation are provided in Drawing 7.

The total estimated installed cost of the turbine/generator unit is $168,000 derived as shown in Table 6.

2.6 Transmission Line

It is suggested that the power transmission line from the site to Oba be constructed on wood poles set alongside the existing access road to the community (Drawing 1). The line will be a 3-phase, 4-wire circuit to economically tie into the existing power distribution system within Oba.

The output from the generator will be stepped up to 2400/4160 volts (line voltage) by three single phase, 50kva pole-mounted transformers. The transmission line should tie into the distribution system at the existing diesel generating station.

In addition to the normal safety devices supplied with the generator, fused circuit breakers will be installed in the transmission lines to protect the transformers and the generator from any surges on the line. Where the transmission line ties into the distribution system in Oba, another set of breakers will be installed to protect that system and to isolate the transmission line from it for maintenance.

Due to the exceptionally low demand for power at times during most days, the hydraulic and diesel system cannot be safely operated simultaneously. When the demand grows and reaches a predictable and practical minimum level, instrumentation can be added to the system so that the base load can be provided by the hydraulic unit, with the diesels on standby for peaking. For the initial installation, the diesels will be instrumented for start-up on power failure, at which time the transmission line from the hydraulic unit will be isolated from the distribution system.

Details of the proposed system are illustrated schematically in Drawing 8.

The total estimated cost of the transmission line is $175,000, determined as shown in Table 7.

3.0 COST SUMMARY

The total estimated cost for a mini-hydro demonstration unit at Oba, determined by this study is $889,450, versus the approximate value of $850,000 estimated during the feasibility study. These are summarized in Table 8.

Of the total cost, some 50 per cent or greater of dam enbankment construction can be ascribed to community road improvement and replacement of the present culvert.

Engineering costs for channel improvements include a major item for hydrology and environmental considerations arising from the perceived influence of the project on both the Oba and the Mattawitchewan River systems.

4.0 ACKNOWLEDGEMENTS

Since April 1982, the firm of MIE Limited has been retained by Morton & Partners Limited to complete several hydro-power aspects of the project, involving Mr. J.D. Jones, P.Eng. Final review of costings has been carried out by Mascen Consultants Incorporated, involving Mr. T. Gangopadhyay, P.Eng.

The continuing major input of senior staff of the Ontario Ministry of Energy and the Micro Hydro Steering Committee is gratefully acknowledged.

Respectfully submitted in final compliance with Contract 8507B, between Morton & Partners Limited and the Ontario Ministry of Energy.

J.D. Morton, M.Eng., P.Eng.
Principal

MORTON & PARTNERS LIMITED

APPENDIX A

TABLE 1

DERIVED FLOW DATA:
MATTAWITCHEWAN RIVER AT THE CHUTES
(m^3/sec)

Mean monthly flow	11
Minimum daily flow	1
Maximum daily flow	81
99% dependable flow	1.5
95% dependable flow	2.1
75% dependable flow	3.5
50% dependable flow	6
5% dependable flow	27

TABLE 2

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
CHANNEL IMPROVEMENTS & PRE-ENGINEERING		
Mobilization	$ 10,000	
Bulldozer, 10 days	9,500	
Dragline, 15 days	23,250	
Service vehicles, 20 days	4,000	
Labour, 5 x 25 days @ $160.00/man day average*	20,000	
Pumps, welders, saws, etc.	2,500	
Room and board, 125 man days	5,000	$ 74,250
Engineering		
Stream gauge installation	20,000	
Stream gauge calibration	10,000	
Site surveys	12,500	
Channel design	7,500	50,000
Environmental, Hydrology and River Hydraulic Studies		25,000
Contingencies		10,750
		$160,000

TABLE 3

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN
AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
DAM		
Mobilization	$ 1,350	
Site preparation	5,000	
Earthfill, 1500 m^3	30,000*	
Filter material, 100 m^3	2,000	
Filter fabric, 300 m^3	3,000	
8" Ø PVC pipe, 70 m	2800	
Rip-rap, 150 m^3	4,500	
Water control	3,000	
Road base, 160 m^3	3,200	
Guide rails, 120 m	3,600	
Room and board, 250 man days	11,200	$ 69,650
Engineering		
Geotechnical investigations	7,500	
Design	7,500	5,000
Contingencies		10,000
		$94,650

* Includes hauling up to 15 km, placing, moisture control, compaction, and restoration of borrow area.

TABLE 4

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
INTAKE STRUCTURE		
Site preparation	$ 2,000	
Excavation, 40 m^3	4,000	
Water control	3,000	
Concrete, 30 m^3	9,000	
Reinforcing	3,600	
Formwork	4,400	
Miscellaneous metal, 0.5t	3,000	
Sluice gates	25,000	
Room and board, 126 man days	5,040	$ 60,040
Engineering		5,500
Contingencies		5,460
		$71,000

TABLE 5

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN
AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
PENSTOCK & BYPASS		
Mobilization	$ 2,000	
Site preparation	3,000	
1500 mm pipe, 200 m @ $750	150,000	
450 mm pipe, 30 m @ $80	2,400	
Inlet transition	15,850	
Expansion joint	11,000	
Rock excavation, 150 m^3	2,500	
Mass concrete, 75 m^3	7,500	
Concrete supports	14,000	
Room and board, 160 man days	6,400	$195,750
Engineering		
Site surveys	2,500	
Design	10,000	12,500
Contingencies		18,750
		$227,000

TABLE 6

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN
AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
TURBINE/GENERATOR		
Mobilization	$ 3,000	
Site preparation	1,000	
Turbine/generator supply	106,000*	
Governor	32,000*	
Installation	2,000	
Concrete foundation, 12 m^3	6,000	
Reinforcing, 0.5T	1,000	
Formwork	1,500	
Rock anchors	1,000	
Anchor bolts	500	
Room and board, 48 man days	2,400	$154,400
Engineering design		2,500
Contingencies		11,100
		$168,000

* As per quotation dated April 14, 1982. See Appendix A.

TABLE 7

BUDGET ESTIMATE BASED ON CONCEPTUAL DESIGN
AND PRELIMINARY ENGINEERING EVALUATION

	1982/83 Estimate	
TRANSMISSION LINE		
Pole line, 7.00 km approximately	$140,000	
3 - 50 kva transformers	3,000	
1 - 50 kva transformers (spare)	300	
Circuit breakers	1,000	
Switches, etc.	10,000	$154,800
Engineering design		2,000
Contingencies		12,000
		$168,800

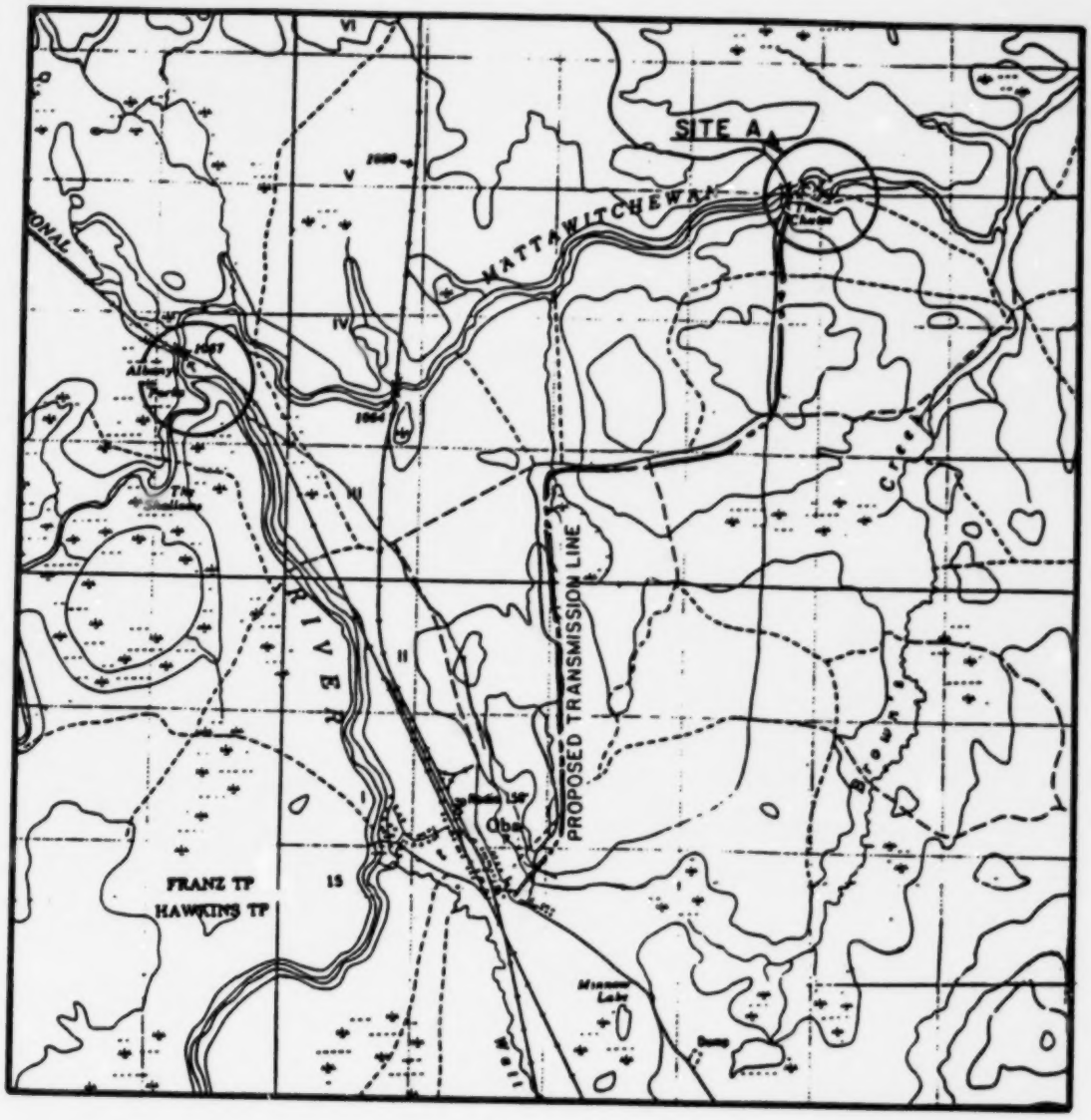
TABLE 8

MORTON & PARTNERS COST SUMMARY

	Engineering	Construction	Contingencies	Total
Channel Improvements	$ 75,000	$ 74,250	$ 10,750	$160,000
Dam	15,000	69,650	10,000	94,650
Intake	5,500	60,040	5,460	71,000
Penstock and bypass	12,500	195,750	18,750	227,000
Turbine/ generator	2,500	154,400	11,100	168,000
Transmission line	2,000	154,800	12,000	168,800
	$112,500	$708,890	$68,060	$889,450

APPENDIX B

PROJECT: 03/81.113



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LOCATION PLAN

Scale	Date	Drawing No
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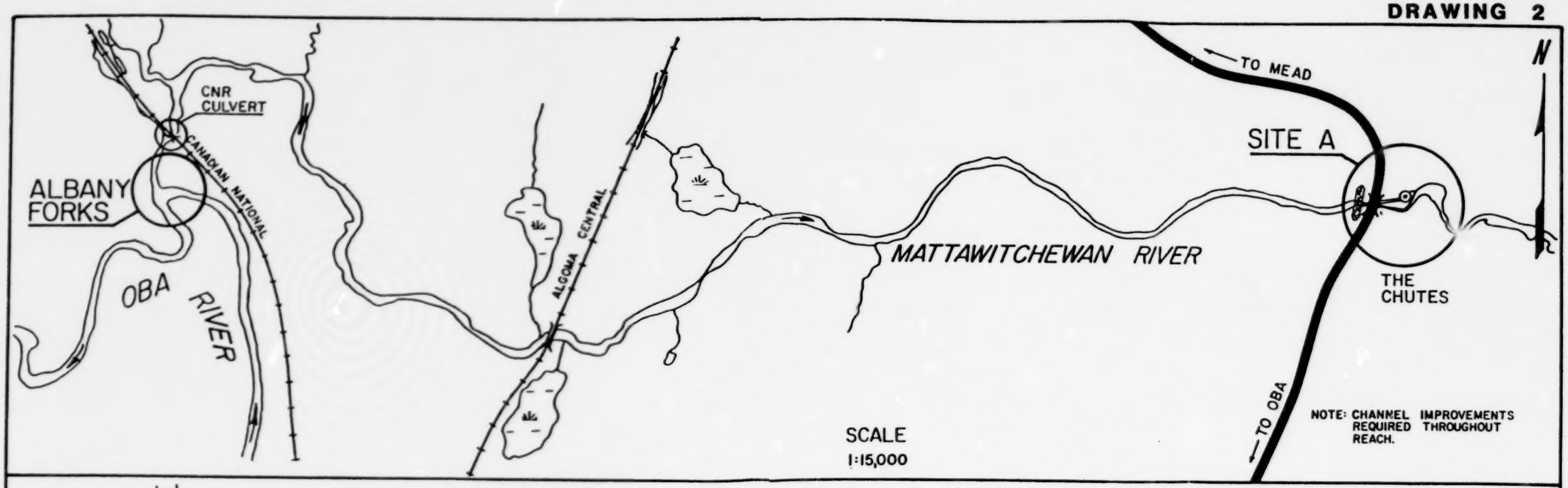
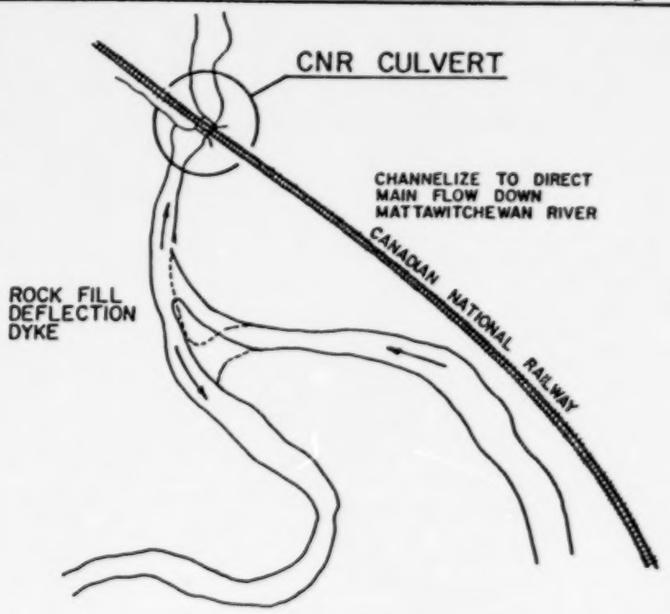
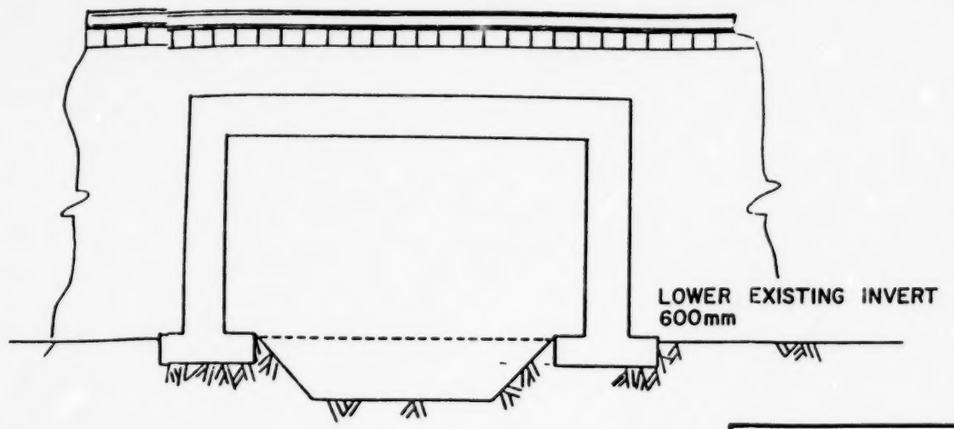
DRAWING 2




CNR CULVERT
CHANNELIZE TO DIRECT MAIN FLOW DOWN MATTAWITCHEWAN RIVER
CANADIAN NATIONAL RAILWAY
ROCK FILL DEFLECTION DYKE

ALBANY FORKS

N.T.S.



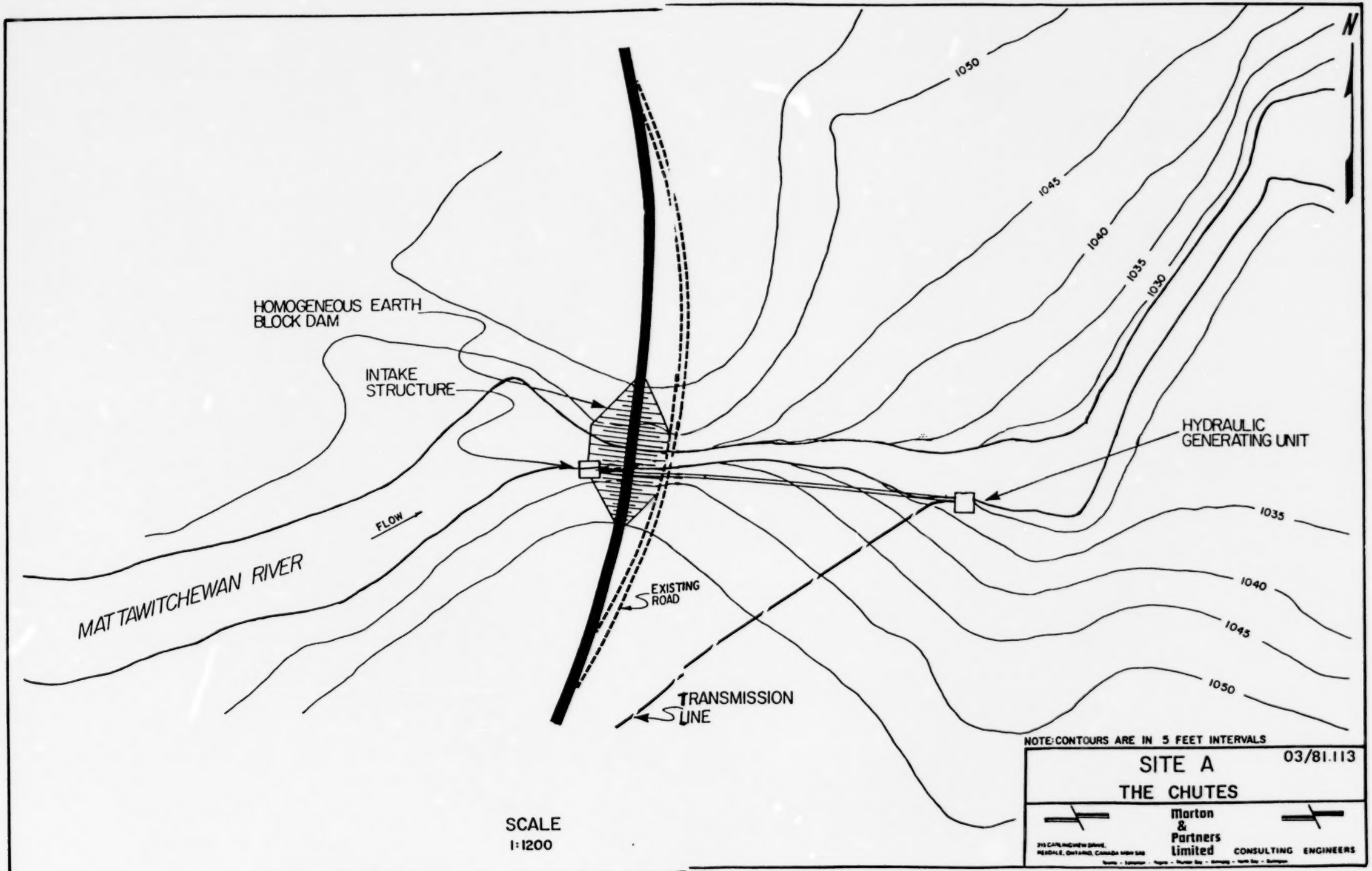
CNR CULVERT

N.T.S.

03/81.113

SITE A – PLAN AND DETAILS

Morton & Partners Limited CONSULTING ENGINEERS
213 CARLINGVIEW DRIVE, REXDALE, ONTARIO, CANADA M9W 5A8



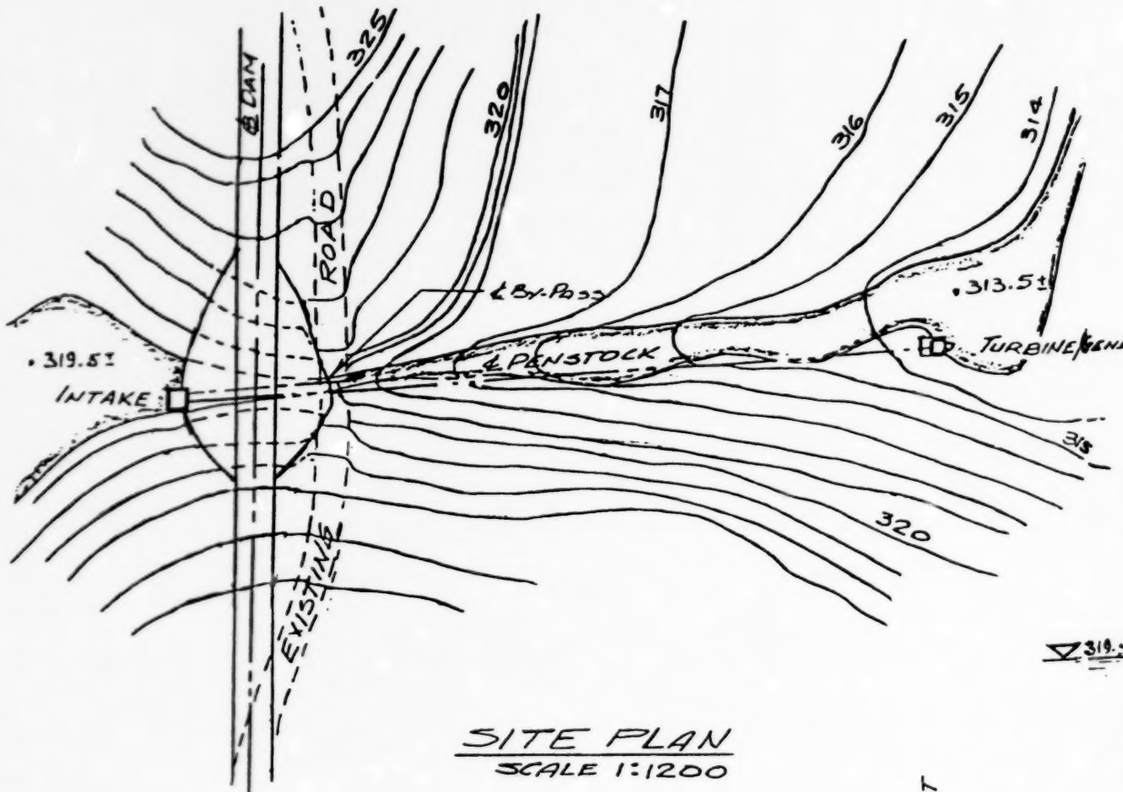
NOTE: CONTOURS ARE IN 5 FEET INTERVALS

SCALE
1:1200

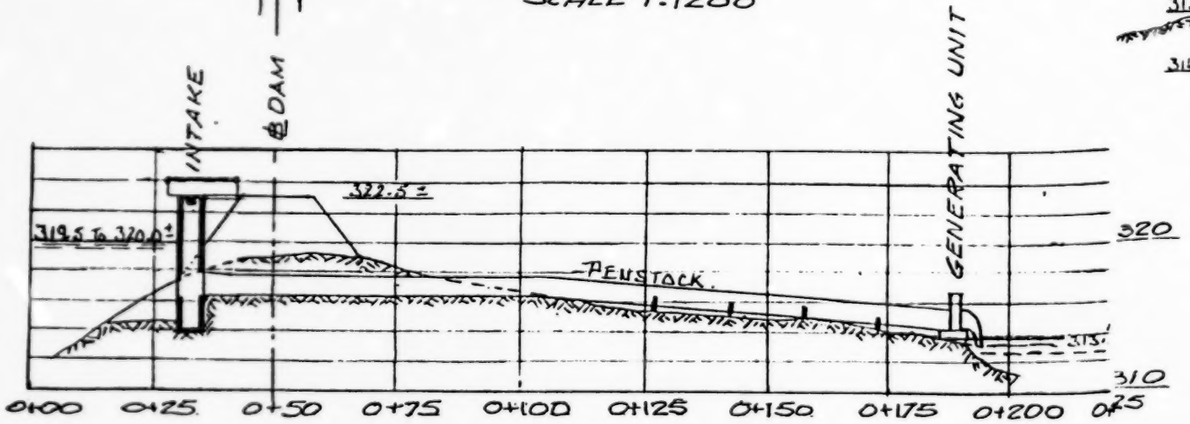
SITE A
THE CHUTES

03/81.113

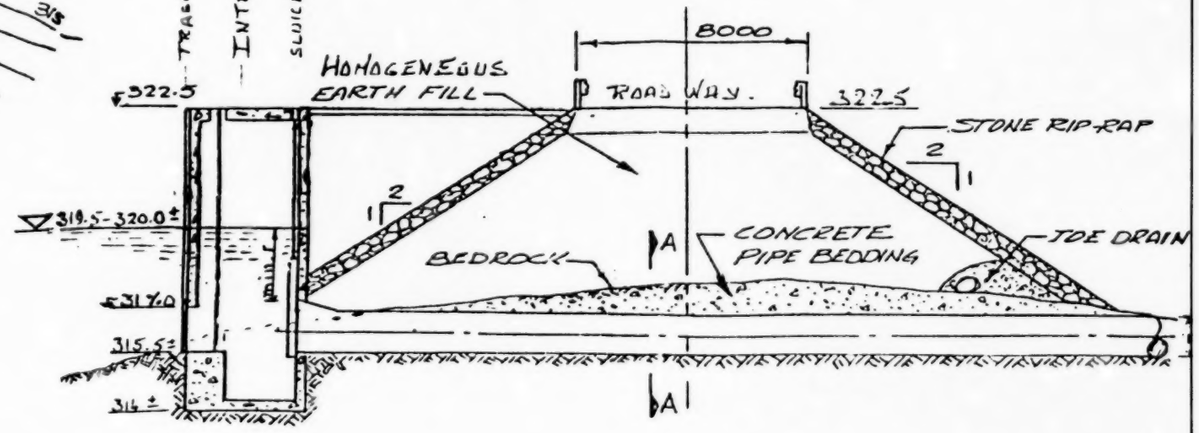
Morton & Partners Limited CONSULTING ENGINEERS



SITE PLAN
SCALE 1:1200



℄ PROFILE ALONG PENSTOCK
SCALE H-1:1200
V-1:800



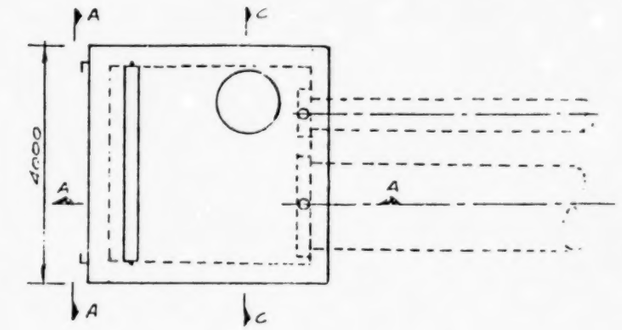
TYPICAL SECTION THROUGH DAM
N.T.S.

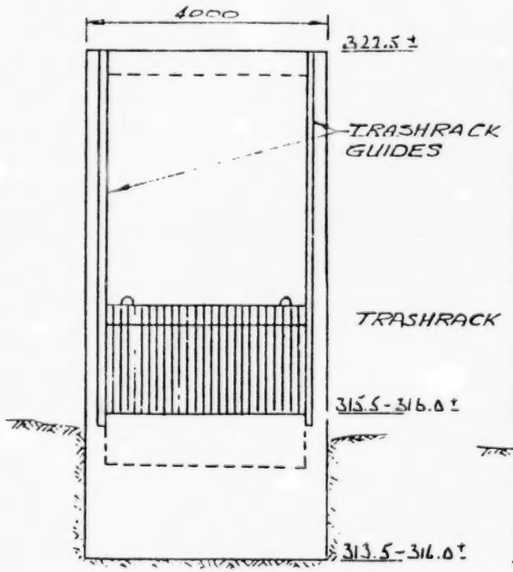
N

MORTON & PARTNERS LTD.

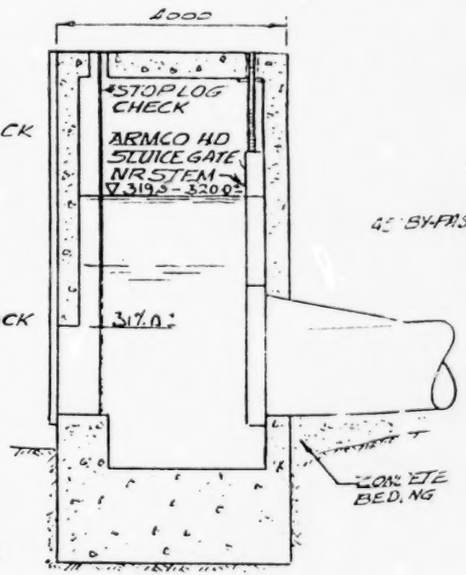
Proposed Dam

03/81.113	Date APRIL 1983	Drawing No 4

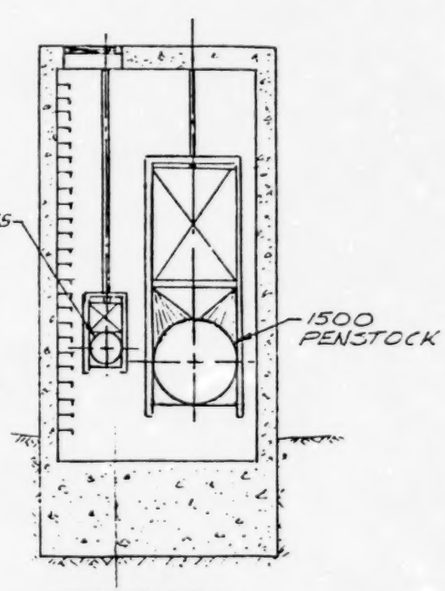




SECTION A-A.



SECTION B-B.



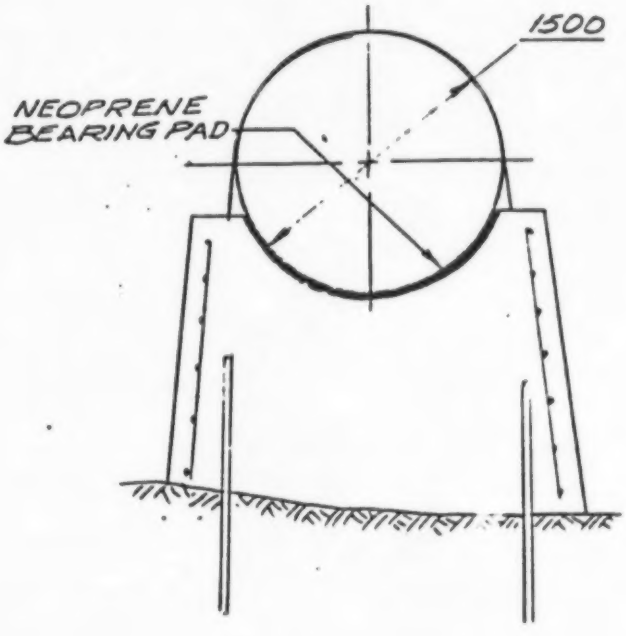
SECTION C-C.

MORTON & PARTNERS LTD.

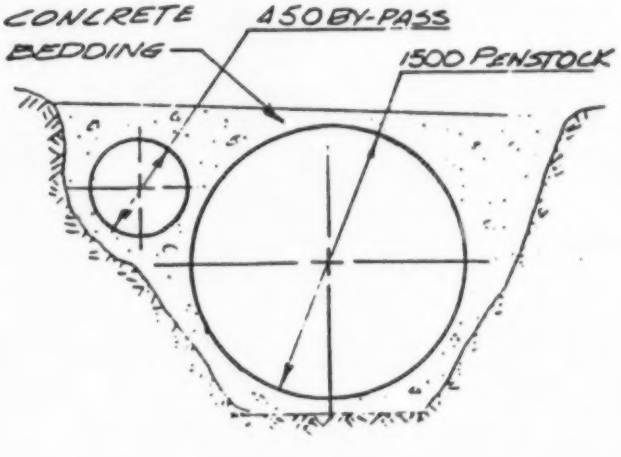
INTAKE STRUCTURE

NTS

03/81.113	Date APRIL 1983	Drawing No 5



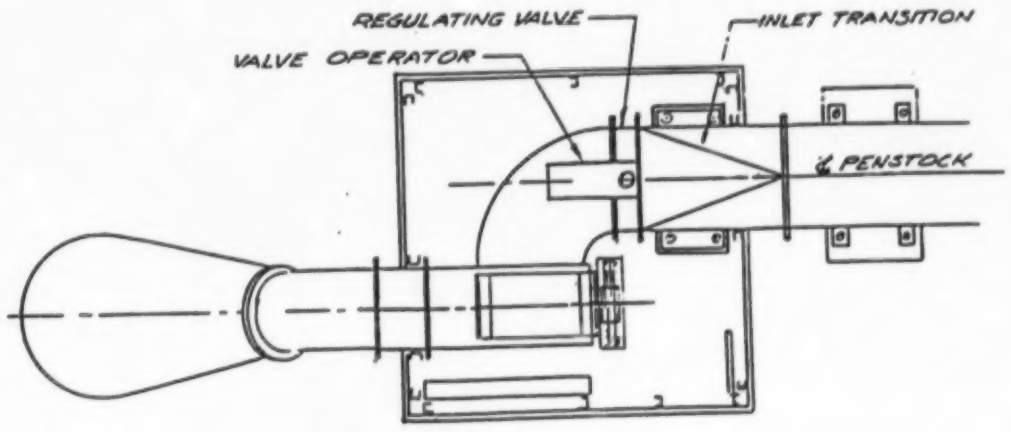
Support

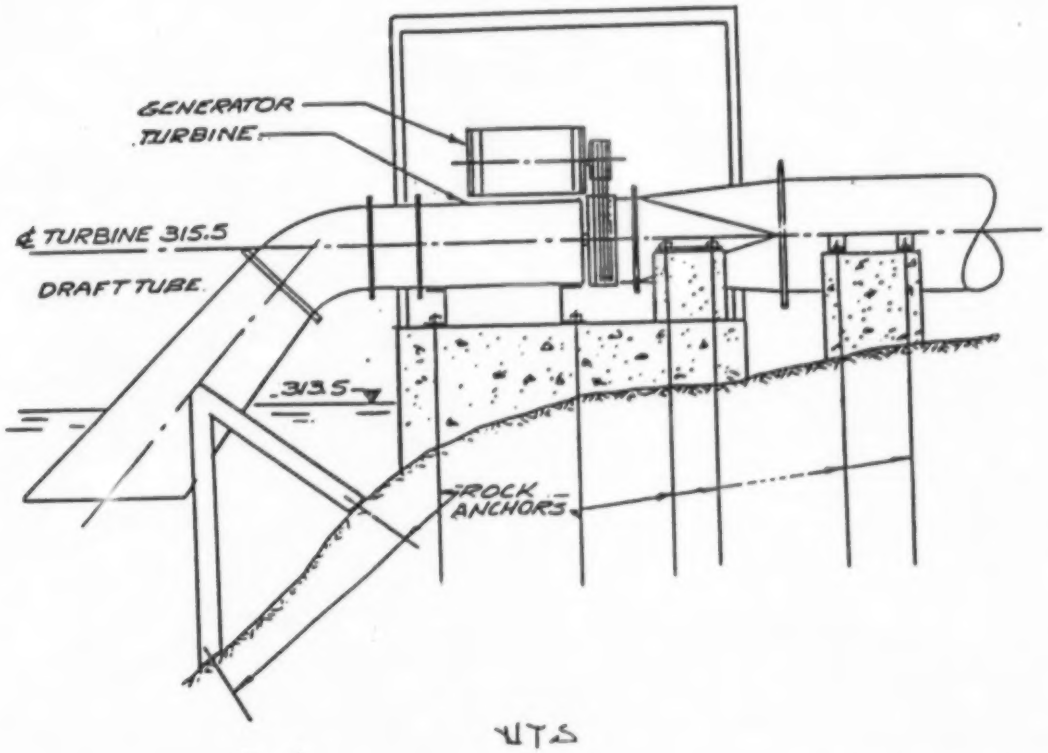


Backfill

Scale: N.T.S

MORTON & PARTNERS LTD.		
Penstock Support and Backfill In Rock Trench		
03/81.113	Date APRIL 1983	Drawing No 6





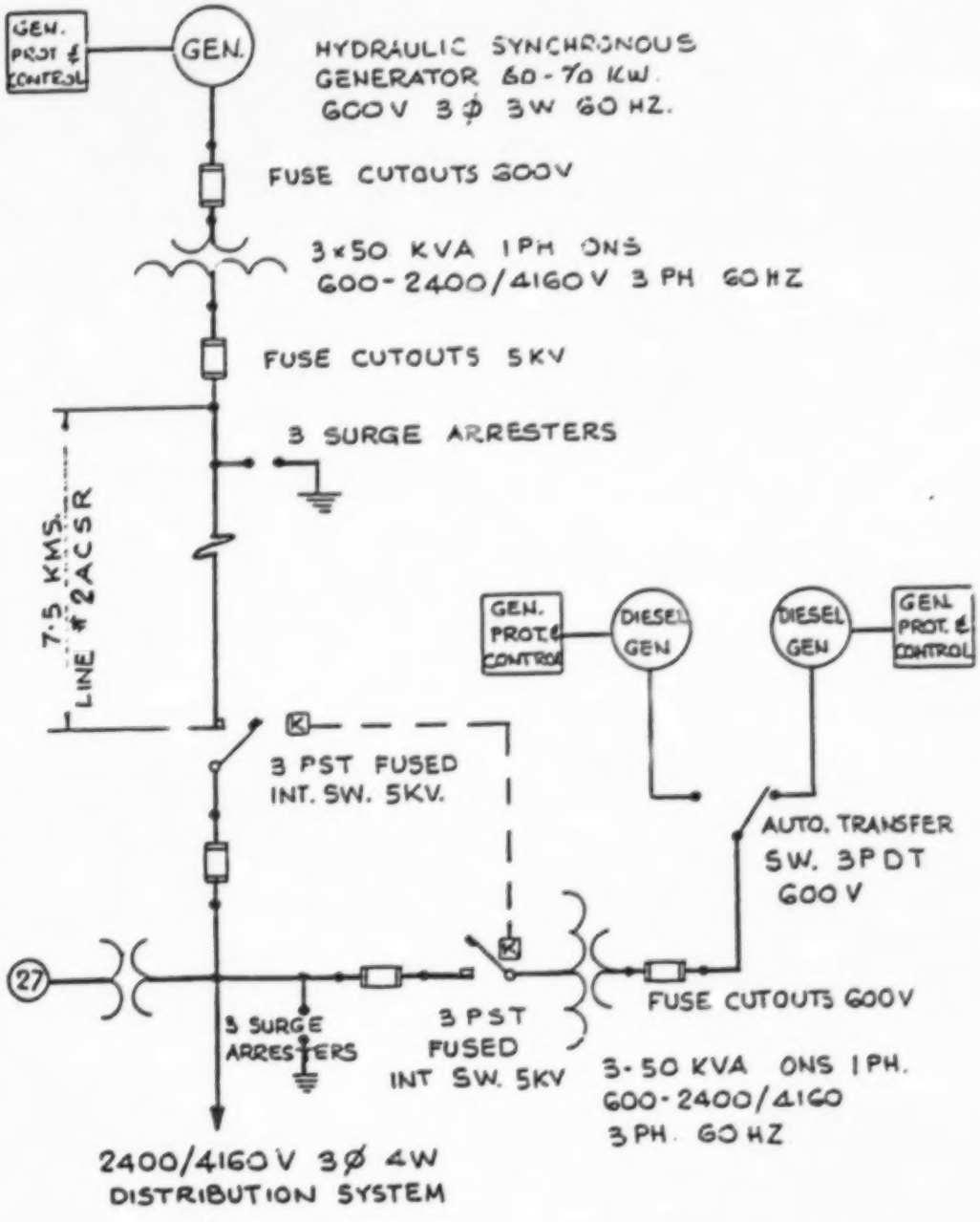
NTS

MORTON & PARTNERS LTD.

Power Unit

Conceptual Details

03/81.113	Date APRIL 1983	Drawing No 7


GEN. PROT & CONTROL
GEN.
HYDRAULIC SYNCHRONOUS GENERATOR 60-70 KW. 600V 3 ϕ 3W 60 HZ.
FUSE CUTOUTS 600V
3×50 KVA 1PH ONS 600-2400/4160V 3 PH 60 HZ
FUSE CUTOUTS 5KV
3 SURGE ARRESTERS
7·5 KMS. LINE #2ACSR
GEN. PROT & CONTROL
DIESEL GEN
DIESEL GEN
GEN. PROT. & CONTROL
3 PST FUSED INT. SW. 5KV.
AUTO. TRANSFER SW. 3PDT 600V
27
3 SURGE ARRESTERS
3 PST FUSED INT SW. 5KV
FUSE CUTOUTS 600V
3-50 KVA ONS 1PH. 600-2400/4160 3PH. 60 HZ
2400/4160V 3 ϕ 4W DISTRIBUTION SYSTEM

MORTON & PARTNERS LTD.

SINGLE LINE DIAGRAM HYDRAULIC GENERATING SYSTEM WITH DIESEL STANDBY

03/81.113	Date APRIL 1983	Drawing No 8

APPENDIX C

EQUIPMENT SUPPLIER INFORMATION

APR 13 1982

GALT ENERGY SYSTEMS LTD.

P.O. BOX 1354 • CAMBRIDGE, ONTARIO, CANADA • N1R 3B0

(519) 653-2531

MORTON & PARTNERS LIMITED,
215 CARLINGVIEW DRIVE,
REXDALE, ONTARIO. M9W 5X8

April 14, 1982

Attn. Mr J.D. Jones, P. Eng.

Dear Sir:

You will find enclosed a copy of drawings number 4-1038 and 4-1039.

Drawing #4-1038 describes an upstream power station, that incorporates all the components for a complete package. This includes stoplogs, intake screens, shut-off valve, turbine, generator, and partial draft tube.

The components are fitted into a rectangular steel chamber that is placed in the river bed upstream of where the dam is to be constructed. An outlet pipe runs from the chamber to tailwater, where it is submerged.

If a 42 inch outlet pipe is used , the exit losses will be .47 feet. A short draft tube can be attached to the end of the 42 inch pipe to increase its diameter to 50 inches and thus reduce the losses to .25 feet.

The weight of the package will be 24,000 pounds.

The overall efficiency of the turbine, speed increaser, generator, and partial draft tube will be 75%.

The turbine will be a Galt Energy Systems side entry, fixed pitch propellor unit.

The governor is an electronic type that imposes an artificial load that is varied to maintain a set point speed within + or - 2%.

The generator is a Kato Engineering model # 4P2-0888, 1800 rpm, 60 kilowatt unit.

A budget price for the above unit is 160,000 dollars F.O.B. Oba.

Delivery will be approximately 6 months from receipt of order.

Drawing #4-1039 describes a model G.S. power station. It incorporates an inlet transition, shut-off valve, turbine, generator, and draft tube, as well as a steel shelter.

The overall efficiency of the turbine, speed increaser, generator, and draft tube will be 72%.

The turbine, generator and speed regulator will be the same as that described for the upstream power station.

A budget price for the unit is 106,000 dollars F.O.B. Oba.

Delivery will be approximately 6 months from receipt of order.

If your customer desires a Woodward type UG Hydraulic Governor in place of the Electronic load shunting governor, we can provide this at an additional cost of 32,000 dollars.
The UG governor would control the turbine speed by modulating the intake butterfly valve. Frequency control accuracy would be dependant on the inlet or outlet piping configuration.

If you wish any additional information on either of the above proposals please contact me.

Yours truly,

Dave de Montmorency, P. Eng.

MAR 3 1982

LEROY SOMER

CANADA Ltd.

Sales Offices
Montreal: (514) 332-1880
Quebec: (418) 653-5361

1364 Blundell Road
Mississauga, Ontario L4Y 1M5
Tel: (416) 270-6225
Telex: 06-961170

Factory
Granby, Canada.

March 26,1982

Morton & Partners Ld
215 Carlingview drive
Rexdale,Ontario
M9W 5X8
Att. Mr J.D. JONES

Your ref: 03.81.113

Dear Sir

We thank you for your request referenced above.You will find enclosed a description manual on our "H" Hydrolec turbine.
We have selected a H6-197 unit with a maximum output of 43.5KW for a given net head of 6 meters and a net flow at the turbine of 45.9 CFS (1.3m3/s).
The manual adjustable blade system allow to operate,for the same net head,at a flow of 28.3 CFS (0.8 m3/s) with an output of 24KW.
Should you need more information,please feel free to contact us anv time.

Truly yours

Bernard Pellegrin
HYDROLEC Division

LEROY SOMER
CANADA Ltd.

Sales Offices
Montreal: (514) 332-1880
Quebec: (418) 653-5361

1364 Blundell Road
Mississauga, Ontario L4Y 1M5
Tel: (416) 270-6225
Telex: 06-961170

Factory
Granby, Canada.

March 26,1982

PRICE QUOTATION

- 1 Hydrolec H6-197 :.....$ 47,370
  This price includes:The compact unit
  Oil tank and oil
  Key for blade adjustment
  Accessories

- Electrical equipment: 1]Parallel to the grid operation
  Electrical panel.....$ 8000
  2]Stand alone operation
  Electrical equipment.....$ 14000
  This price includes:Electrical panel
  Electronic governor
  Bank of resistors
  Bank of capacitors

- Delivery: 22 weeks from signature of purchase agreement
- Prices are FOB Toronto
- Freight from Toronto to Oba: To be evaluated
- Our quotation is valid for 30 days

SMALL HYDRO - ELECTRICS CANADA LTD.

P.O. BOX 54 SILVERTON, BRITISH COLUMBIA V0G 2B0

TELEPHONE 358-2406 AREA CODE 604
TELEX: 041-4150 CABLE: SMALL HYDRO, NELSON

April 16, 1982

Mr. J. D. Jones
Vice-President
Morton & Partners Ltd.
215 Carlingview Drive
Rexdale, Ontario
M9W 5X8

Dear Sir:

Your letter of March 22 concerning the Oba, Ontario project is received and noted with interest. Enclosed herewith is information on this company and our products. You will note that our activities include importation of bare-shaft turbines from two sources - China National Machinery Corp. in Peking, and Hobkroften Engineering of Sweden. Generators, controls and ancillaries, as necessary, are supplied from Canadian or U.S. manufacturers and the system is completed here in B.C.

To meet the requirements at Oba, we would supply a Hobkroften Series 80 tubular turbine, size 60 (M). Performance curves for the Standard size 60 are enclosed, The size 60 M would use a quide-vane and propellor pitch modification to increase flow to 1.42 M^3/s. at 6 m. head. Operating speed would increase to 720 rpm, with 92 shaft horsepower. The generator supplied would be a Kato 720 rpm synchronous 3 phase two bearing, code 10P5-0413 rated 60 kW continuous at 80°F rise. The governor supplied will be a Thomson and Howe ELC (information enclosed). This is an electronic load controlling type governor, capable of 1% regulation. The governor may be located in a suitable building in the village, or at the generator. Certain economies may be realized by locating the governor in the Village at a communal-use space (laundrymat, or?) which can make good use of the system's excess energy which, via the ELC governor, uses resistance loads (space and/or water heating) to sink energy. The turbine will be supplied with a butterfly type intake valve with hydraulic actuator. The valve will be capable of being operated remotely (from the governor location), manually, and automatically by way of an energy system shutdown capability triggered by over/under frequency or turbine over/under speed.

As you will note from the enclosed sketches, the Series 80 turbine is quite versatile in its installation configurations. This versatility may be economically advantageous at Oba in that rather than supply a complete package powerhouse unit, the turbine/ generator/valve actuator may be supplied for outdoor installation (enshrouded). The complete enshrouded unit would be shipped ready for installation on our specified

.....2

foundation. Savings would be realized on supply, shipment, and installation costs. These savings are reflected in the budgeting quotations elsewhere.

The final design of draft tube, etc. will be to the advantage of the site's requirements. Turbine typical extreme dimensions are noted on the enclosed sketches. We are awaiting a telex from the Hobkroften factory concerning submergence requirements; however, we are confident that requirements will be minimal, thereby reducing on-site costs.

For budgeting purposes we recommend you allocate the following:

Scheme A: complete packaged and prefabricated powerhouse per your letter of March 22, 1982 - $112,000, f.o.b. Oba, Ontario.

Shipment, ex factory, will be approximately five months after receipt of order. Major dimension of (powerhouse) enclosure will be approximately 7' wide x 20' long x 8' high. Total estimated weight is 14,000 pounds.

Scheme B: enshrouded turbine/generator/etc. for outdoor installation: $103,000, terms and delivery as above.

Total estimated weight - 8,500 pounds.

Note that the above quoted figures include up to 8 man days (2 men x 4 days) on site by employees of this company to supervise installation, plant startup and training for operation and maintenance personnel. Critical spares for generator, turbine and governor are included as well.

We trust that you will find the above and the enclosed of interest, and we will be pleased to be of further service.

Yours truly,

SMALL HYDRO-ELECTRICS CANADA LTD.

Craig P. Murphy

CPM/wh
Encls.

MAR [illegible] 1982

March 25, 1982

Morton & Partners Limited
215 Carlingview Drive
REXDALE, Ont.
M9W 5X8

Attn: Mr. J.D. Jones, P.Eng.
Vice President

Dear Mr. Jones:

Thank you for your enquiry on small hydro-electric generating equipment.

We regret that we are far too busy to become involved with any Government Ministry.

Sincerely,

McKAY WATER POWER LTD.

Harry J. McKay
HJM:ed
Enc: McK,HYDROPAC, M77

TELEX 06[illegible]-5352

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